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10EC/TE61

Sixth Semester B.E. Degree Examination, June/July 2014

Digital Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain natural sampling with relevant waveforms. Give all the necessary time-domain and frequency-domain equations. **(10 Marks)**

b. What is aliasing error? Give two corrective measures to remove the effect of aliasing in practice. **(04 Marks)**

c. Consider the analog signal $x(t) = 5\cos(2000\pi t) + 10\cos(6000\pi t)$.

i) What is the Nyquist rate and Nyquist interval?

ii) Assume that if we sample the signal using sampling frequency $f_s = 5000$ Hz, what is the resulting discrete time signal obtained after sampling?

iii) Draw the spectrum of the sampled signal. **(06 Marks)**

2 a. Explain regenerative repeater in a PCM system with a block diagram. **(05 Marks)**

b. The bandwidth of a signal is 3.4 kHz. If this signal is converted to PCM bit stream with 1024 levels, determine the number of bits per second (bps) generated by the PCM system. Assume that the signal is sampled at the rate of 20% above the Nyquist rate. **(06 Marks)**

c. Derive an expression for the output SNR of a uniform quantizer in terms of step size of the quantizer. Hence show that for mid-tread type uniform quantizer the SNR is $(SNR)_{output} = 6n - 7.2$ dB, where 'n' is the number of bits per sample. Assume a loading factor of 4. **(09 Marks)**

3 a. Explain with block diagrams DPCM transmitter and receiver. **(09 Marks)**

b. Explain briefly the basic optical fiber link used for the transmission of digital data. **(06 Marks)**

c. Show that for the bipolar format, the autocorrelation function $R_a(n)$, that is $E[A_K A_{K-n}]$ is zero for $n > 1$, where A_K is the K^{th} random variable representing K^{th} bit of the input binary sequence. Assume statistically independent and equally likely message bits. **(05 Marks)**

4 a. Explain raised cosine spectrum solution to reduce ISI. **(10 Marks)**

b. The binary data 001101001 are applied to the input of the duobinary system.

i) Construct the duobinary coder output and the corresponding receiver output without a precoder.

ii) Suppose that due to error during transmission, the level at the receiver input produced by the second digit is reduced to zero. Construct the new receiver output. **(10 Marks)**

PART – B

5 a. Explain the generation and demodulation of DPSK wave with block diagrams. **(08 Marks)**

b. Binary data are transmitted over a microwave link at the rate of 10^6 bps and the PSD of the noise at the receiver input is 10^{-10} Watts per hertz. Find the average carrier power required to maintain an average probability of error $Pe \leq 10^{-4}$ for coherent binary FSK. What is the required channel band width? (Take $erfc(2.7) = 2 \times 10^{-4}$) **(06 Marks)**

c. Explain briefly phase tree and phase Trellis in MSK. **(06 Marks)**

6 a. What is a signal vector? Show that the energy of a signal is equal to the squared length of the signal vector representing it. **(08 Marks)**

b. Explain the Gram-Schmidt orthogonalization procedure to obtain the orthonormal basis functions for the linearly independent set of signals. **(12 Marks)**

7 a. Show that the output SNR of a metched filter is proportional to the ratio of the signal energy to the PSD of input noise. **(06 Marks)**

b. Explain the noncoherent quadrature receiver using correlators. **(06 Marks)**

c. Consider the signal s(t) as shown in the Fig.Q7(c). Determine the impulse response of the filter matched to s(t). Plot the impulse response and matched filter output as a function of time.

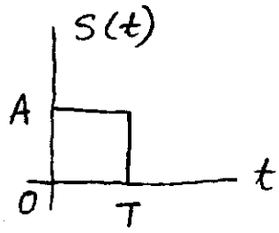

Fig.Q7(c) **(08 Marks)**

8 a. Define processing gain and jamming margin. **(04 Marks)**

b. What is the role of PN sequence in spread spectrum communication? For the given PN sequence 0011101 verify the properties of it. **(08 Marks)**

c. Discuss briefly the applications of spread spectrum technique to (i) CDMA, (ii) Multipath suppression. **(08 Marks)**

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